

### Claims

What is claimed is:

1. A velocity controller for an electric motor, said motor having an input PWM signal and a motor current, said velocity controller comprising:

5 (1) an estimator connected to said motor, said estimator adapted to use fuzzy logic to generate an estimated motor velocity after receiving said PWM signal and said motor current; and

(2) a PI controller connected to said estimator and said motor, said PI controller adapted to generate a PWM signal after receiving a reference velocity and said estimated motor velocity.

2. The controller in claim 1 wherein said PI controller comprises:

(1) an initial summing junction which compares said reference velocity and said estimated motor velocity and generates an error signal;

5 (2) an integrator which receives said error signal and generates a value for multiplication by an integral constant;

(3) a means for multiplying said error signal by a proportional constant;

(4) a means for multiplying said value received from said integrator by an integral constant; and

10 (5) a final summing junction which add the value of the signal generated by said proportional constant means and the value of the signal generated by said integral constant means and generates a sum as a PWM signal to said motor.

3. A priming station disposed in a printer having a print head, said priming station comprising:

(1) a cap connected to a cap carriage, said cap carriage being operably connected to a helical gear and being adapted to move in a path;

5 (2) a motor connected to a worm gear, said worm gear being operably connected to said helical gear so that when said motor is energized said cap carriage will move along said path;

(3) said cap carriage having a prime position along said path, said prime position occurring when said cap comes to a stop against said print head when said print head is in a prime position;

(4) a blotter positioned to stop and blot said cap as said cap travels to a blotting position along said path; and

(5) a velocity controller controlling said motor, said motor having an input PWM signal and a motor current, said velocity controller comprising:

(i) an estimator connected to said motor, said estimator adapted to use fuzzy logic to generate an estimated motor velocity after receiving said PWM signal and said motor current; and

(ii) a PI controller connected to said estimator and said motor, said PI controller adapted to generate a PWM signal after receiving a reference velocity and said estimated motor velocity.

4. The priming station in claim 3 wherein said PI controller comprises:

(1) an initial summing junction which compares said reference velocity and said estimated motor velocity and generates an error signal;

(2) an integrator which receives said error signal and generates a value for multiplication by an integral constant;

(3) a means for multiplying said error signal by a proportional constant;

(4) a means for multiplying said value received from said integrator by an integral constant; and

(5) a final summing junction which add the value of the signal generated by said proportional constant means and the value of the signal generated by said integral constant means and generates a sum as a PWM signal to said motor.

5. A method for controlling the velocity of a DC electric motor, said motor having an input PWM signal and a motor current, said method comprising the following steps:

(1) providing said PWM signal and said motor current to an estimator connected to said motor;

- (2) using said estimator, generating an estimated motor velocity using fuzzy logic;
  - (3) providing a reference velocity and said estimated motor velocity to a PI controller; and
  - 10 (4) using said PI controller, generating a PWM signal based upon said reference velocity and said estimated motor velocity.
6. The method in claim 5, comprising the additional step of calibrating said motor by the following method:
- a) choosing at least one PWM duty cycle value of interest;
  - b) applying a startup PWM duty cycle of sufficient magnitude to ensure  
5 motion of said motor;
  - c) performing a first test wherein the first chosen duty cycle is applied in at least two periods, each of said periods being of opposite polarity from the period preceding it, and the current in said motor is measured during each of said periods;
  - 10 d) performing a test for each additional chosen PWM duty cycle value of interest, wherein each of said PWM duty cycles is applied in at least two periods, each of said periods being of opposite polarity from the period preceding it, and the current in the motor is measured during each of said periods; and
  - 15 e) calculating the apparent resistance of the motor.